

CLAIMS:

1. Door state changing apparatus for assisting a user to move a door between a closed state where the door is positioned adjacent a door frame and an open state comprising:

5 permanent magnet means on or attached to said door to provide a permanent magnetic field,

10 electromagnet means on or attached to said door frame adjacent said permanent magnet means when said door is in said closed state, which electromagnet means is energisable to provide a magnetic field in a first direction to reinforce said permanent magnetic field and energisable to provide a magnetic field in a second direction to oppose said permanent magnetic field

15 door position detection means to detect the state of said door,

20 user interface means to detect the presence of a user attempting to alter the state of said door, and

25 control means which receives input from said door position detection means and said user interface means and provides a control signal to energise said electromagnet means to provide a magnetic field in said first direction if said user interface means indicates a user is attempting to alter the state of said door and said door position detection means indicates that said door is in said open state and provides a control signal to energise said electromagnet means to provide a magnetic field in said second direction if said user interface means indicates a user is attempting to alter the state of said door and said door position detection means indicates that said door is in said closed state.

30 2. Door state changing apparatus as claimed in claim 1 wherein said electromagnet means is de-energised when said door position detection means indicates that said door is in said closed position.

3. Door state changing apparatus as claimed in either claim 1 or claim 2 wherein said control means includes delay means which provide a time delay between said door position detection means detecting said closed state and de-energising said electromagnet means.

4. Door state changing apparatus as claimed in any one of claims 1 to 3 wherein said user interface means include sensing means which cover a region of the surface of said door.

5. Door state changing apparatus as claimed in any one of claims 1 to 4 wherein said user interface means comprise door state change direction detecting means which provide said control means with an indication of the direction of the change of state of said door and to cause said control means to energise said electromagnet means to provide a magnetic field in said first direction if said door state change direction detecting means indicates a user is attempting to alter the state of said door from an open state to a closed state and to cause said control means to energise said electromagnet means to provide a magnetic field in said second direction if said door state change direction detecting means indicates a user is attempting to alter the state of said door from a closed position to an open position.

10. Door state changing apparatus as claimed in any one of claims 1 to 5 wherein the strength of the magnetic field provided by said electromagnet is variable.

15. Door state changing apparatus as claimed in claim 6 wherein the strength of said magnetic field in said second direction is greater than or equal to the strength of said permanent magnetic field.

20. Door state changing apparatus as claimed in any one of claims 1 to 7 wherein said door position detection means comprise proximity detection means provided on or attached to said door frame which detects the proximity of said permanent magnet means.

25. Door state changing apparatus as claimed in claim 8 wherein said proximity detection means comprise means to sense the inductance of said electromagnet means.

10. Door state changing apparatus as claimed in any one of claims 1 to 9 wherein said permanent magnet means is formed in a substantially "U" shape with the ends of the legs of said "U" directed towards said electromagnet means and with opposing magnetic poles at the end of each leg.

30. 11. Door state changing apparatus as claimed in any one of claims 1 to 10 wherein said electromagnet means comprise a substantially "U" shaped core of

magnetically permeable material and an energisable winding around said core, the ends of the legs of said "U" shape being directed towards the legs of said permanent magnet means.

12. Door state changing apparatus as claimed in any one of claims 1 to 11

5 wherein said permanent magnet means is positioned on or near the centre line of said door.

13. A home appliance including a cabinet and a door hingeably connected to said cabinet and closeable against a door frame said appliance including door state changing apparatus for assisting a user to move said door between a closed state and an open state where said door is positioned adjacent said door frame and an open state, said door state changing apparatus comprising:

permanent magnet means on or attached to said door to provide a permanent magnetic field,

electromagnet means on or attached to said door frame adjacent said permanent magnet means when said door is in said closed state, which electromagnet means is energisable to provide a magnetic field in a first direction to reinforce said permanent magnetic field and energisable to provide a magnetic field in a second direction to oppose said permanent magnetic field

20 door position detection means are also provided to detect the state of said door,

user interface means to detect the presence of a user attempting to alter the state of said door, and

25 control means which receives input from said door position detection means and said user interface means and provides a control signal to energise said electromagnet means to provide a magnetic field in said first direction if said user interface means indicates a user is attempting to alter the state of said door and said door position detection means indicates that said door is in said open state and provides a control signal to energise said electromagnet means to provide a magnetic field in said second direction if said user interface means indicates a user is attempting to alter the state of said door and said door position detection means indicates

- 15 -

that said door is in said closed state.

14. A refrigerator including door state changing apparatus as claimed in any one of claims 1 to 12.

15. A refrigerator including door state changing apparatus substantially as herein described with reference to and as illustrated by the accompanying drawings.